

Remarks

Applicant respectfully requests reconsideration of this application. Claims 2, 8, 9, 11, 22, 23 and 25 are pending. Claims 2, 8-9, and 23 have been allowed. None of the pending claims have been amended.

Traversal of Claim Rejections - 35 U.S.C. § 103

Claims 11, 22 and 25 stand rejected under 35 U.S.C. §103 as being unpatentable over Fluke et al. (US 6,313,973; "Fluke") or Gill (US 6,271,997; "Gill") either one taken with either Kawawake et al. (US 201/0046110; "Kawawake") or Sakakima et al. (US 6,567,246; "Sakakima") in further view of Fukuzawa et al (US 6,338,899; "Fukuzawa"). Applicant respectfully traverses this ground of rejection.

The Office Action first states that Fluke or Gill teaches a basic spin-valve type magnetoresistance sensor structure but concedes that neither of these references teaches a reflective layer of a metallic oxide. Actually, Gill teaches a dual spin valve sensor characterized by a structure in which the free layer is arranged between two magnetization fixed layers (e.g., pinned layer 208 and a self-pinned layer 210) with spacer layers 206 and 204 separating the free layer structure 202 from the respective pinned layers 208 & 210 (see Figure 12; col. 6, lines 18-36; col. 7, lines 10-20). According to Fluke, an advantage of a dual spin valve sensor structure is that is possible to obtain higher output as compared to a conventional spin-valve film having a single fixed layer.

Applicant respectfully submits that the dual spin-valve MR sensor structure taught by Gill (and Figures 5 & 7 of Fluke) is distinguished from a single-sided spin-valve magnetoresistive sensor and therefore incompatible with the combination of references cited by the Examiner. The reason why is because the dual spin-valve structure requires two magnetization pinned layers disposed on opposite sides of the free layer.

Thus, Applicant respectfully submits that a person of ordinary skill seeking to increase the MR ratio in a spin-valve type of MR sensor would have lacked motivation to combine either Kawawake or Sakakima with Fukuzawa, and further with either Gill or the embodiments of Figures 5 & 7 in Fluke, which also teach a dual spin-valve structure. (Only the embodiments of Figures 4 & 6 in Fluke teach a basic single-sided spin-valve type structure.) In other words, Applicant respectfully contends that Gill or the embodiments of Figures 5 & 7 in Fluke are not properly combined with the other references cited by the Examiner.

Fluke, in his embodiments of Figures 4 & 6, only teaches a conventional spin-valve MR sensor structure that includes a protective layer 8 formed adjacent the free layer, with the composition of the protective layer being selected in view of the lattice matching with the free layer. Fluke specifically teaches his protective layer 8 being formed of a metal film that acts both as a distortion control layer for the underlying layers and to support a cap layer. (See col. 19, lines 1-9). Fluke, however, fails to teach or suggest a non-magnetic back layer disposed adjacent to the free layer in combination with an electron-reflective layer that adjoins the non-magnetic back layer.

The Office Action goes on to state that either Kawawake or Sakakima teach the inclusion of an electron-reflective back layer, but admits that neither reference teaches an electron-reflective back layer that comprises tantalum oxide layer. However, according to the Office Action this missing claim limitation is met by the disclosure in Fukuzawa of a TaO layer 147 in his Figure 17 structure. The Examiner concludes that it would have been obvious to one having ordinary skill in the art at the time of the invention to adopt the reflective layer with oxide such as shown by Kawawake or Sakakima in spin-valve type MR sensors of Fluke or Gill for the purpose of increasing efficiency, and have an TaO layer, as suggested by

Fukuzawa, to provide increased wear protection. Applicant respectfully disagrees for the reasons given below.

In his embodiment of Figure 5, Kawawake teaches a dual spin-valve structure in which a metal reflective layer 6 is provided on the surface of an antiferromagnetic layer 9-2. (Paragraph [0116]) When the antiferromagnetic layer is not in contact with the metal-reflective layer, the other antiferromagnetic layer (i.e., 9-1 in Figure 5) is formed on a conventional insulating underlayer, which lies on top of a substrate 1. The free magnetic layer 3 is sandwiched between non-magnetic spacer layers 4 in accordance with the basic dual spin-valve sensor structure. Importantly, Kawawake fails to teach or suggest a structure in which a non-magnetic back layer is disposed adjacent to his free magnetic layer on a side of the free magnetic layer opposite the non-magnetic spacer layer, in combination with an electron-reflective layer that adjoins the non-magnetic back layer on a side of the non-magnetic back layer opposite the free magnetic layer. In addition, Kawawake fails to teach or suggest the use of any material other than a metal as his reflective layer. Nowhere does Kawawake teach a back layer disposed adjacent an electron-reflective oxide layer.

Applicant respectfully submits that a person of ordinary skill would have lacked motivation to combine Kawawake with Fluke's teachings of his Figures 4 & 6 because the dual spin-valve type structure (of Kawawake) is basically incompatible with a single-sided spin-valve type structure (of Fluke's Figures 4 & 6). More fundamentally, Kawawake fails to teach, disclose, or suggest any of the claimed structural elements in relationship to one another.

Sakakima teaches a magnetoresistance effect element in which an oxide non-magnetic film 6 having good flatness is provided on the free layer so that electrons are mirror-reflected on the upper surface of the free layer 5. (See col. 9, lines 7-13). Sakakima emphasizes that the interface between the oxide non-magnetic film and the free layer must have good flatness characteristics (i.e., pits

and protrusions of about 0.5 nm or less) in order to obtain sufficient reflection and thereby achieve a high MR ratio. As pointed out by Applicant, such a structure is known to suffer from deterioration of the magnetic characteristics of the soft magnetic layer. (See specification, paragraphs [0008]-[0010]). Consequently, Applicant respectfully submits that a person of ordinary skill in the art would be aware of the shortcomings of Sakakima's structure and would therefore lack motivation to combine his teachings with the conventional spin-valve sensor structure, as taught by Fluke's Figures 4 & 6 embodiments. Additionally, Sakakima lacks any disclosure or suggestion of an electron-reflective film comprising a tantalum oxide layer disposed adjacent a non-magnetic back layer on a side of the non-magnetic back layer opposite the free ferromagnetic layer, as recited in the pending claims.

Regarding the Examiner's reference to Figure 17 of Fukuzawa, this structure (and the corresponding portions of the specification) is similar to that taught by Figure 4 of Fluke, wherein a protective film 147 covers a free magnetic layer 146. Fukuzawa's teaching that his protective film may consist of an oxide is the same as Sakakima's structure. But as pointed out above, a spin-valve sensor structure that consists of an oxide layer disposed adjacent the free magnetic layer is known to suffer from deterioration of the magnetic characteristics of the free (i.e., soft) magnetic layer. An ordinary practitioner would therefore have been discouraged from modifying or changing the traditional spin-valve sensor structure (as taught by Fluke's Figure 4) consistent with the teachings of either Fukuzawa or Sakakima in view of the known problems associated with forming an oxide layer (TaO or any other oxide) on the free magnetic layer.

Moreover, Fukuzawa teaches away from the combination of cited references when he disparages the use of a Ta film as a protective layer laminated on the surface of a metal back layer (e.g., a Au film). As Fukuzawa clearly states, when Ta

is utilized as a film adjoining a Au metallic back layer, "[T]he Au film loses its mirror reflectivity... and are therefore not practicable." (Col. 61, line 65 through col. 62, line 5)

What is missing from Fukuzawa, and from the other cited references, is any teaching or suggestion of a spin valve MR sensor structure that includes a non-magnetic back layer disposed adjacent the free layer on a side of the free magnetic layer opposite the non-magnetic spacer layer, *and* an electron-reflective layer disposed adjacent the non-magnetic back layer on a side of the back layer opposite the free magnetic spacer layer. Indeed, given Fukuzawa's disparaging remarks about the use of a Ta layer adjoining a metallic back layer, Applicant respectfully submits that one of ordinary skill in the art would have been discouraged from combining Fukuzawa with the other cited references in the manner suggested by the Examiner.

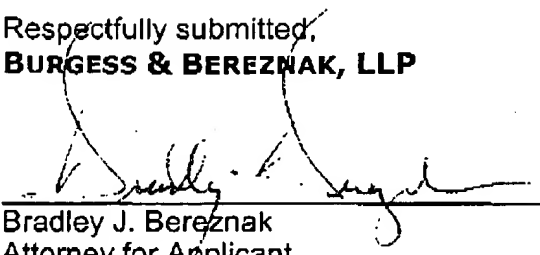
The combination of Fluke or Gill, taken with Kawawake or Sakakima, taken further in view of Fukuzawa, fails to teach, disclose, or suggest a magnetoresistive sensor with an electron-reflective film comprising a tantalum oxide layer or film disposed adjacent to the non-magnetic back layer on a side of the non-magnetic back layer opposite the free ferromagnetic layer. Because this structural feature is not disclosed in or suggested by any of the cited references, or their combination, it is respectfully submitted that the subject matter of rejected claims 11, 22 and 25 would not have been obvious to a person of ordinary skill in the magnetic recording arts at the time the invention was made in view of the prior art.

Applicant therefore respectfully submits that all remaining claims are now in condition for allowance.

Please charge any shortages and credit any overcharges to our Deposit
Account No. 50-2060.

Respectfully submitted,
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